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Distribution of the flower beetle *Pseudodiceros nigrocyaneus* (Bourgoin, 1917) (Coleoptera: Scarabaeidae: Cetoniinae) in Asia with biological notes

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Keywords:

Lamellicornia; Goliathini; Rhomborhinina; *Pseudodiceros*; lectotype; designation; larva; Asia; Oriental region; China; Vietnam.

Abstract. – The geographical distribution of the Asian flower beetle *Pseudodiceros nigrocyaneus* (Bourgoin, 1917) is updated. The general habitus and diagnostic characters of the species are illustrated, and the lectotype is designated. The natural history of this species is also documented. The larvae feed on rotten wood in nature, which differs from the larval feeding habit of most Asian Goliathini.

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Introduction

Adults of many genera in the tribe Goliathini Latreille, 1829 have somewhat modified morphological characters, such as the clypeus, frons, or pronotum with protrusions, tibiae curved or prolegs elongated in males, the body surfaces densely clad with scales, and larger body size (Krikken 1984; Sakai & Nagai 1998). Among the genera ad species of this tribe distributed in Asia, *Pseudodiceros nigrocyaneus* (Bourgoin, 1917) appears to be unique because of its unmodified features, uniform body color, and smaller body size. This species was initially placed in the genus *Dicheros* Gory & Percheron, 1833, and at first glance looks like a member of the subgenus *Dicheros* (*Coryphe*) Macleay, 1838 (*sensu* Mikšić 1974) which is without protrusion in the head too. Later Mikšić (1974) established the monotypic genus *Pseudodiceros* for this species and clearly indicated the differences from *Dicheros*: lateral part of the abdomen with long and abundant pubescence, and the hind tibiae with a central tooth on the outside. Apart from the difference in body color, this species is also similar to *Periphanesthes aurora* (Motschulsky, 1858), but the latter has a shorter mesometasternal process, with the tip rounded and not bent toward the sternum, and the posterior margin of its elytron distinctly serrate (Qiu *et al.*, 2014). Specimens of *Pseudodiceros nigrocyaneus* are poorly represented in collections and this results in limited knowledge of its distribution. This species was originally discovered in Yunnan, and during the past century there have also been scattered reports from northern Vietnam (Paulian 1960), Chongqing, Hunan, and Hubei in China (Mikšić 1977; Ma 1992; Sakai & Nagai 1998; Krajčík 2011). Nevertheless, these widely separated localities suggested that this beetle occurs extensively in southwestern China and northern Vietnam. In the past decade, several surveys were conducted in China, and many specimens of this species were obtained, which enabled us to revise its distribution range. Moreover, we have also been able to observe the habits of the adult and larva which are hitherto unknown.

In the present paper, we update the distribution information of *Pseudodiceros nigrocyaneus* with a modern map, and document its natural history based on field observation and artificial rearing.

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Materials and methods

For artificial breeding, wild-collected beetles and larvae were raised in plastic containers (30×20×19 cm) filled with a 15-cm layer of wet, rotten oak wood pieces at a temperature of around 25°C. Ripe bananas were provided as food for adults (Fig. 32). The containers were regularly checked for the development of larvae and in order to provide supplementary rotten wood.

Body length was measured from the anterior margin of the clypeus to the apex of the elytron, and body width was measured at the base of the elytra (the maximum width of elytra). Terminology of other morphological characters follows Krikken (1984) and Qiu *et al.* (2014). Photographs of specimens were taken using a Canon macro lens EF 100 mm f/ 2.8 USM on a Canon 90D camera fixed on the Laowa E01 rail. The app WeMacro 4.0 through Bluetooth technology was used to control the camera when used for macro photography focus stacking. The final deep-focus images were created with Helicon Focus 7.0.2 Pro. All plates were finally modified in Adobe Photoshop CS5.

The collecting localities (Fig. 22) from labels and published records (see the citation section) were mapped in QGIS 3.28.11 based on the map from Tianditu (www.tianditu.gov.cn) and modified in Adobe Photoshop CS5. References marked with an asterisk (*) after the taxon names in the citation section refer to voucher specimens that were examined by the authors. All label data of the type specimens and other historical specimens are transcribed *verbatim*. Data on the verso side of the same label are separated by a single slash, and different labels are separated by a double slash. Our remarks are enclosed in square brackets, except for part of the collection label of F.T. Valck Lucassen (at RMNH) which was already printed with "[O.E. Janson]" indicating the source of those specimens (Fig. 19). The abbreviation "hw." is used for handwriting on the label of historical specimens; otherwise, the letters on the label were printed.

This work is based on the study of more than 140 specimens, and the following abbreviations for collections are used (curators are listed in parenthesis):

BMNH: The Natural History Museum, London, United Kingdom (Maxwell V.L. Barclay);
CCCC: Chang-Chin Chen Personal Collection, Tianjin, China;
FSPC: Feng-Yi Sun personal collection, Shenzhen, China;
GFGY: Guizhou Academy of Forestry Sciences, Guiyang, China (Zai-Hua Yang);
GUGC: Guizhou University, Guiyang, China (Mao-Fa Yang);
HBUM: Hebei University Museum, Baoding, China (Guo-Dong Ren);
HFRI: Hunan Academy of Forestry Sciences, Changsha, China (Mi Li);
HLSC: Hong-Liang Shi personal collection, Beijing, China;
IBGZ: Institute of Biology, Guizhou Academy of Sciences, Guiyang, China (Hui-Ming Chen);
IRSNB: Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium (Alain Drumont);
KSCJ: Kaoru Sakai personal collection, Tokyo, Japan;
MNHN: Muséum National d'Histoire Naturelle, Paris, France (Antoine Mantilleri);
MYNU: Invertebrate Collection of Mianyang Normal University, Mianyang, China;
MYPC: Mao Ye personal collection, Xiangyang, China;
NSMT: National Museum of Nature and Science, Tokyo, Japan (Shuhei Nomura);
NWAU: Entomological Museum, Northwest Agriculture and Forestry University, Yangling, China (Bao-Zhen Hua);
RMNH: Naturalis Biodiverity Center, Leiden, Netherlands (Oscar Vorst);
RYPC: Ren-Jie You personal collection, Huaihua, China;
SMPC: Shi-Ming Mao personal collection, Hangzhou, China;
YYPC: Yi-Wei Yao personal collection, Hanzhong, China;
ZXPC: Zi-Yue Xiong personal collection, Shiyan, China.

Results

Pseudodiceros Mikšić, 1974
Pseudodiceros nigrocyaneus (Bourgoin, 1917)
(Fig. 1-39)

Diceros nigrocyaneus Bourgoin, 1917: 277* (Type locality: Pe-Yen-Tsin, Yunnan, Chine [= Baiyanjing, former name of nowadays Shiyang Town, in Dayao Co., Yunnan, China]);
- Schenkling 1921: 52;
- Mao 1937: 1080;
- Paulian 1960: 171* (Hoa Binh, Northern Vietnam);

Coryphocera nigrocyaneus (Bourgoin):
- Schürhoff 1933: 97.

Pseudodiceros nigrocyaneus (Bourgoin):
- Mikšić 1974: 751 (type species designation);
- Mikšić 1977: 192 (Giufu Shan, Szechuan [Mt. Jinfoshan, Chongqing, China]), fig. 27 parameres;
- Ma 1992: 442* (southern Hunan), fig. 1355 ♀;
- Ma 1995: 73;
- Sakai & Nagai 1998: 238* (Mt. Jinfo-Shan, China), figs. 686-1 ♂, 686-2 ♀;
- Krajčík 1998: 22 (catalogued);
- Smetana 2006: 303 (catalogued);
- Krajčík 2011: 21 (Shilin, Yunnan & Mt. Wudangshan, Hubei)*;
- Krajčík 2012: 228 (catalogued);
- Bezděk 2016: 396 (catalogued);
- Allsopp & Schoolmeesters 2024: 52 (catalogued);
- Krajčík 2024: 47 (catalogued).

Type material examined

Locality, sex, specimen numbers, and depository of Bourgoin's type specimens were given in the original publications since 1916. However, *Pseudodiceros nigrocyaneus* is an exception, as he did not provide the number of specimens, but mentioned both sexes. The label data of one male and one female in BMNH (Bourgoin's collection) conforms to those given in the original publication (Bourgoin 1917), thus both are regarded as syntypes of *P. nigrocyaneus*, although the species name given in Bourgoin's handwritten type label as "nigrocyanea" differs from that reported in the original publication. The rectification of the species name was probably due to Bourgoin recognizing that the gender of the generic name is masculine. Four additional female "cotypes" of *P. nigrocyaneus* were found in MNHN and RMNH (Fig. 18-21), but they cannot be treated as syntypes because their body length does not match the measurements given in the original description. Moreover, the place names on their labels are somewhat different in spelling. These four inauthentic type specimens perhaps were acquired directly from the insect dealer Henri Donckier de Donceel (1854-1926) in Paris.

To enhance the stability of nomenclature, the male syntype in BMNH is here designated as **lectotype** (Fig. 16), with the following data: Pé-yen-Tsin, yunnan [hw.]// Bourgoin Coll., B.M. 1938-252// Diceros nigrocyanea [sic!], Bourgoin, ♂, Type [hw.]// SYN-TYPE. The female paralectotype (BMNH, Fig. 17) carries the following labels: Pé-yen-Tsin, yunnan [hw.]// Bourgoin Coll., B.M. 1938-252// Diceros nigrocyanea [sic!], Bourgoin, ♀, Type [hw.]// Co-type// SYN-TYPE.

Additional material examined

China (Shaanxi)

- **2** ♂, **1** ♀ (MYNU), Ankang City, Hanbin District, Chenjiazhuang Village, alt. 481, 2023.VIII.15, Zi-Qi WANG leg.;
- **1** ♂ (NWAU), Ankang City, Shiquan County, 1960.VII.24;

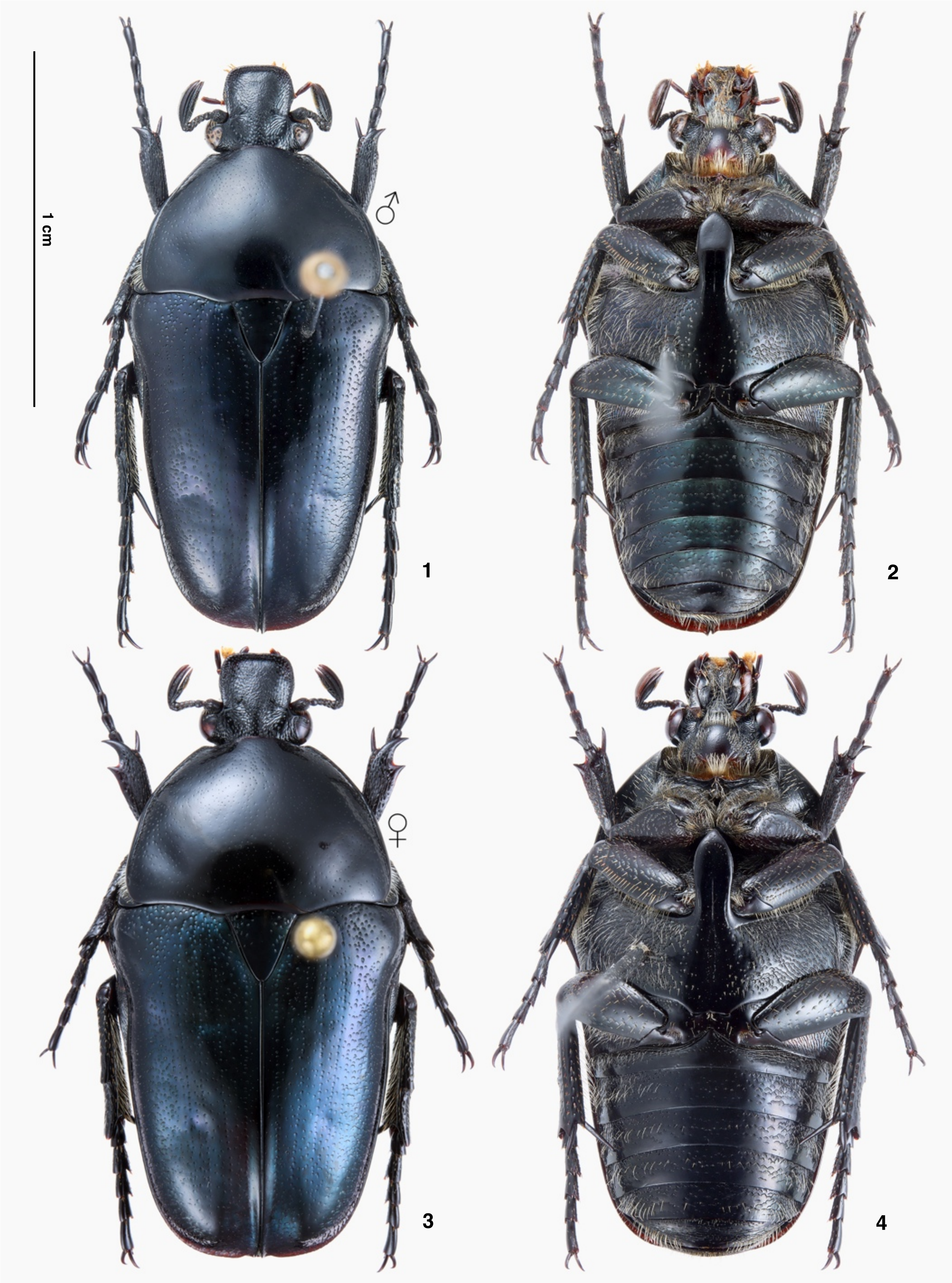


Fig. 1-4. Habitus of *Pseudodiceros nigrocyaneus* (Bourgoin, 1917).
1-2. ♂ (Guiyang, China). **3-4**. ♀ (Chongqing, China). **1**, **3**. Dorsal view. **2**, **4**. Ventral view.

- **2** ♀ (NWAU), Ankang City, Ningshan County, 1960.VII.24;
- **1** ♀ (YYPC), Hanzhong City, Mianxian Co., Mt. Tiandangshan, alt. 695 m, 2023.7.10, by fruit trap in Oak trees, Yi-Wei YAO leg.;
- **1** ♀ (YYPC), Hanzhong City, Hantai District, Nanyihuan Road, Yuxiyuan Neighborhood, 2017.VII, Jun YAO leg.;
- **1** ♀ (YYPC), Hanzhong City, Hantai District, Nanyihuan Road, Yuxiyuan Neighborhood, 2017.VI, Jun YAO leg.;
- **1** ♂, **3** ♀ (KSCJ), Qin Ling, Zhenba County, Shaanxi, CHINA, 1997.VII.2// Pseudodiceros nigrocyaneus (Bourgoin, 1917), det. K.Sakai, 2016;

China (Sichuan)

- **1** ♀ (KSCJ), 1992.VII.7, Luding, Sichuan, Wako Kotauaki// Pseudodiceros nigrocyaneus (Bourgoin, 1917), det. K.Sakai, 2016;
- **1** ♂, **1** ♀ (KSCJ), Mt. Shi Gang, Wanyuan City, Sichuan, China, 3-9.VIII.1997// Pseudodiceros nigrocyaneus (Bourgoin, 1917), det. K.Sakai, 2016;
- **1** ♂, **2** ♀ (MYNU), Liangshan Pref., Dechang Co., Mali town, Luchang Village, alt. 1800 m, 2022.VII.8, Hao XU, Xin-Yuan ZHANG & Hui WEN leg.;
- **2** ♂, **5** ♀ (MYNU), F1 generation of the females from Liangshan Pref., Dechang Co., Mali town, Luchang Village, alt. 1800 m, 2023.VI.13 adults eclosed;
- **1** ♂ (MYNU), Mianyang City, Beichuan Co., Guixi Town, Linfeng Village, Wujiahoushan, 2022.VIII.4, Yao-Yu YANG leg.;
- **2** ♂, **1** ♀ (MYNU), Guangyuan City, Zhaohua District, Dachao Township, Xinfan Village, 2023.I.30 3rd Larvae, 2023.IV adults eclosed, Yong ZHOU leg.;
- **1** ♀ (MYNU), Bazhong, Nanjiang Co., Yangba Town, Yuanyangba, 2024.VIII.18, Yong ZHOU leg.;
- **1** ♂, 1 ♀ (MYNU), Bazhong, Nanjiang Co., Hongta Park, alt. 585 m, 2024.VIII.11, Ding ZHOU leg.;
- **1** ♂, **3** ♀ (MYNU), Luzhou City, Gulin Co., 2011.VII.28, Lu QIU leg.;
- **1** ♀ (MYNU), Luzhou City, Gulin Co., Zhangde Town, Liushayan, 2014.V, Lu QIU leg.;
- **3** ♂ (MYNU), F1 generation of the female from Luzhou City, Gulin Co., Zhangde Town, Liushayan, 2015.V adults eclosed;
- **2** ♂, 1 ♀ (MYNU), Luzhou City, Gulin Co., Honglonghu Forestry Park, 2021.IV.15 adults eclosed, An-Jun SHUI leg.;
- **1** ♂, **4** ♀ (MYNU), Mianyang City, Pingwu Co., Long'an Town, Longchiping Forestry Park, 104°31.60' E, 32°24.58' N, alt. 1000 m, 2019.VII.6-8, Hao XU & Jian-Yue QIU leg.;
- **7** ♂, **12** ♀ (MYNU), F1 generation of the females from Mianyang City, Pingwu Co., Long'an Town, Longchiping Forestry Park, 2020.V.10 adults eclosed;
- **1** ♀ (MYNU), Mianyang City, Pingwu Co., Long'an Town, Longchiping Forestry Park, 2021.V.29, Jian-Yue QIU, Yu-Tang WANG & Hui WEN leg.;
- **3** ♂, **1** ♀ (MYNU), F1 generation of the female from Mianyang City, Pingwu Co., Long'an Town, Longchiping Forestry Park, 2022.V adults eclosed;
- **2** ♀ (MYNU), Mianyang City, Pingwu Co., Long'an Town, Longchiping Forestry Park, 2022.VIII.15, Hao XU, Ting XIONG & Cheng-Bin WANG leg.;
- **1** ♂ (MYNU), Mianyang City, Pingwu Co., Gucheng Town, Baicao Village, Mt. Qiuzhushan, 2022.VIII.15, Hao XU, Ting XIONG & Cheng-Bin WANG leg.;
- **1** ♂ (MYNU), F1 generation of the female from Mianyang City, Pingwu Co., Long'an Town, Longchiping Forestry Park, 2023.VI.1 adult eclosed;

China (Chongqing)

- **6** ♂, **3** ♀ (MYNU), Jiangjin District, Simianshan Natural Reserve, Dawopu, 2013.VI.23 3rd Larvae, 2014.V.3 adults eclosed, Hao XU & Jian-Yue QIU leg.;
- **17** ♂, **8** ♀ (MYNU), F1 generation of the females from Jiangjin District, Simianshan Natural Reserve, Dawopu, 2015.V adults eclosed;
- **1** ♂ (MYNU), Jiangjin District, Simianshan Natural Reserve, Majiagou, 2014.VIII, Hao XU leg.;
- **1** ♀ (MYNU), Jiangjin District, Simianshan Natural Reserve, Mt. Huaguoshan, Laoyuchi, 2014.I.18 3rd Larva, 2014.V adult eclosed, Hao XU & Jian-Yue QIU leg.;
- **3** ♂, **1** ♀ (MYNU), Jiangjin District, Simianshan Natural Reserve, Mt. Huaguoshan, Wubaolin, 2014.II 3rd Larvae, 2014.VI adults eclosed, Hao XU & Jian-Yue QIU leg.;
- **1** ♂, **1** ♀ (MYNU), Nanchuan District, Jinshan Town, Longshan Village, Mt. Jinfoshan, 2023.VII.2, Yong ZHOU leg.;
- **4** ♂, **4** ♀ (KSCJ), Mt. Jinfo Shan, Dalou Shan Range, Sichuan, CHINA, 1996.V-VI// Pseudodiceros nigrocyaneus (Bourgoin, 1917), det. K.Sakai, 2016;
- **2** ♀ (KSCJ), Jinfo Shan, Sichuan, CHINA, 1996.VII// Pseudodiceros nigrocyaneus (Bourgoin, 1917), det. K.Sakai, 2016;

China (Hubei)

- **1** ♂ (BMNH), CHINA, HUBEI Prov. WUDANG SHAN Mts. 32'16 N-110'57 E, 1500m, VIII-IX.2000// Pseudodiceros nigrocyaneus// BMNH{E}, 2015-37 Milan Krajčík;
- **1** ♀ (MYPC), Xiangyang City, Nanzhang Co., Changping Town, Feicuixia, 2015.VII.19, Mao YE leg.;
- **1** ♂, **1** ♀ (MYPC), Xiangyang City, Baokang Co., Beiyugou, 2015.VI adults eclosed, Mao YE leg.;
- **1** ♀ (ZXPC), Shiyan City, Danjiangkou, Mt. Wudangshan, gate of Nanshendao, 2023.X.1, Zi-Yue XIONG leg.;
- **1** ♂ (MYNU), Yichang City, Dangyang, Yuquan Temple, 2016.VII.26, Hu LI leg.;

China (Hunan)

- **1** ♀ (HFRI), Quanping, [19]87.VI.4;
- **1** ♀ (HBUM), Mt. Hupingshan, Shimen County, 2004.VIII.17, Ji-Liang WANG leg.;
- **1** ♂ (MYNU), Mt. Hupingshan, Shimen County, 2018.VII, Ming-Wei LIAO leg.;
- **1** ♂ (RYPC), Huaihua City, Zhongfang Co., Zhongfang Town, Fangxi Reservoir, 2024.IX.11, Ren-Jie YOU leg.;
- **1** ♀ (HFRI), 1046, Huai[i.e., Huaihua], Huang [i.e., Xinhuang County], 7.12.[year unknown], Jia-Xing LIU leg.;
- **2** ♀ (IRSNB, Alexis Coll.), CHINE HUNAN, Wuling Shan, Rong leg., VIII.1997, R.ALEXIS Coll.;

China (Guizhou)

- **10** ♂, **2** ♀ (IBGZ), Guizhou, Huangping County// [19]87.VII.28;
- **1** ♀ (HBUM), Xishui County, Dabaitang, 2000.IX.25-29, Guo-Dong REN leg.;
- **1** ♀ (GFGY), [Bijie City], Jinsha County, Lengshuihe, 2015.VIII.4-8, Xiu-E ZHU, Bin YAN, Yao-Wen ZHANG leg.;
- **1** ♀ (MYNU), Qiannan Pref., Libo Co., Maolan National Natural Reserve, Wuyanqiao, 2011.VII.19-20, Qiong-Zhang SONG leg.;
- **1** ♂ (MYNU), Qiannan Pref., Libo Co., Weng'ang Township, Maolan National Natural Reserve, La'nei Village, 107°55.22' E, 25°14.61' N, alt. 800 m, 2013.VII.26, Hao XU & Jian-Yue QIU leg.;
- **1** ♂ (MYNU), Qiannan Pref., Libo Co., Weng'ang Township, Maolan National Natural Reserve, Shishangsenlin, 2018.VII.21, Xiao-Han YE leg.;
- **1** ♂ (MYNU), Qiannan Pref., Guiding Co., Yunwu Town, Pingfa Village, 2019.VI.13, Peng TANG leg.;
- **1** ♀ (MYNU), Qiannan Pref., Guiding Co., Yunwu Town, 2024.V.23, Peng TANG leg.;
- **1** ♂, **3** ♀ (HLSC), Guiyang City, 2000-2008, studentes of Guizhou University leg.;
- **1** ♂ (GUGC), Qingyan Town, Guiyang City, 2010.VI.22, Bing-Fu PENG leg.;
- **1** ♂ (GUGC), Qingyan Town, Guiyang City, 2010.VII.8, Bing-Fu PENG leg.;
- **1** ♂, **1** ♀ (MYNU), Guiyang City, 2019.VII.29;
- **1** ♂ (GFGY), Guiyang City, Guiyang Forestry Park, alt. 1300 m, 1984.VII.27, Jing-Hua ZHAO, Qun WANG, Yan-Xian LIU leg.;
- **1** ♂ (MYNU), Guiyang City, Nanming District, Tuyunguan, Guiyang Forestry Park, 106°44.78' E, 26°33.05' N, alt. 1250 m, 2012.VIII.7 3rd larva, 2013.V adult eclosed, Hao XU & Jian-Yue QIU leg.;
- **1** ♀ (MYNU), Guiyang City, Nanming District, Tuyunguan, Guiyang Forestry Park, 2016.IV.18, Bo-Yan LI leg.;
- **1** ♂ (MYNU), Guiyang City, Nanming District, Tuyunguan, Guiyang Forestry Park, 106°44.78' E, 26°33.05' N, alt. 1250 m, 2015.VI.20 3rd larva, 2016.V adult eclosed, Hao XU & Jian-Yue QIU leg.;
- **2** ♂ (MYNU), Guiyang City, Nanming District, Tuyunguan, Guiyang Forestry Park, 2016.IX.8;
- **1** ♂, **1** ♀ (MYNU), Guiyang City, Nanming District, Tuyunguan, Guiyang Forestry Park, 2017.VIII.21, Ming-Zhi ZHAO leg.;

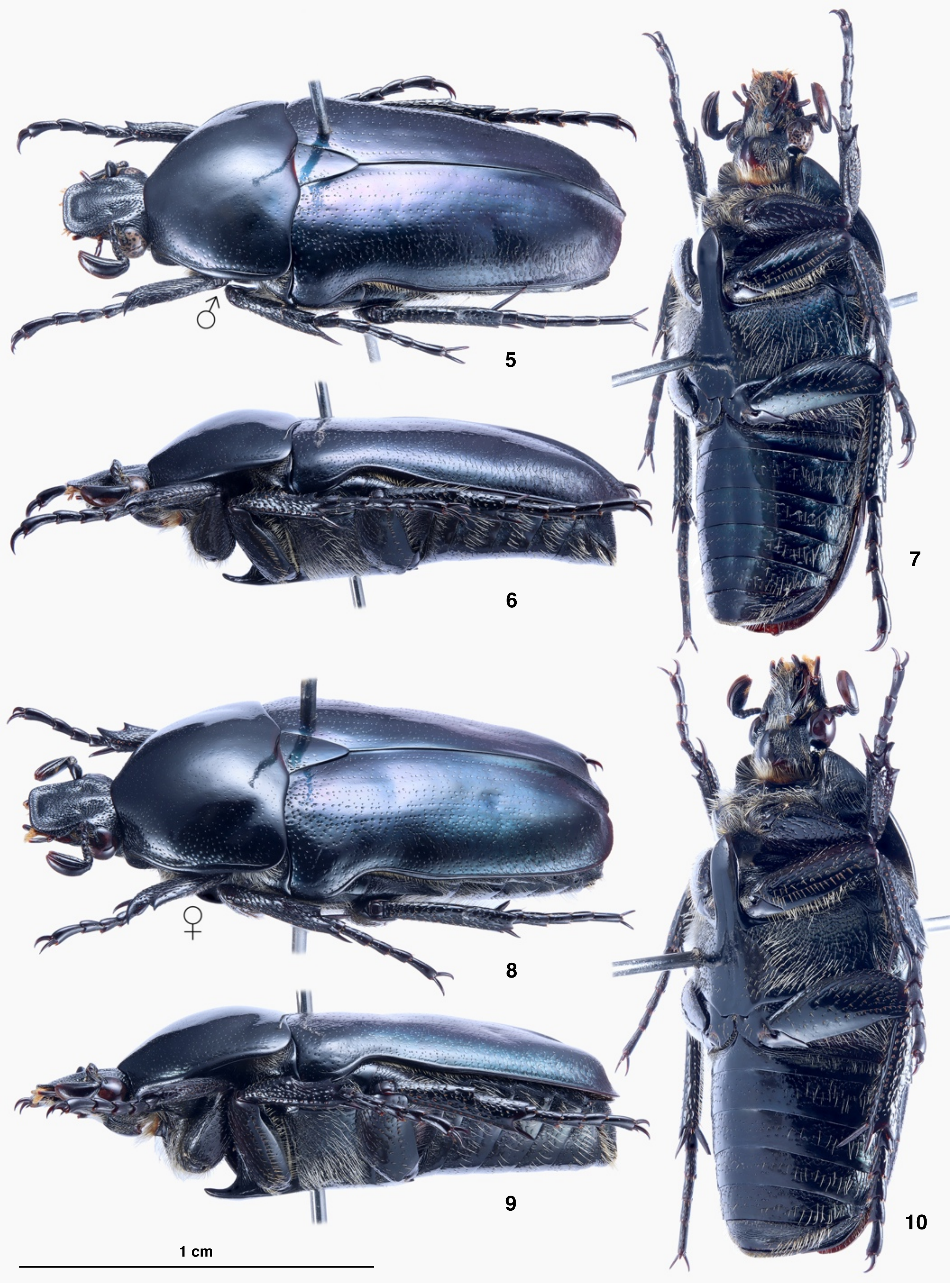


Fig. 5-10. Habitus of *Pseudodiceros nigrocyaneus* (Bourgoin, 1917).
5-7. ♂ (Guiyang, China). **8-10**. ♀ (Chongqing, China). **5**, **8**. Dorso-oblique view. **6**, **9**. Lateral view. **7**, **10**. Ventro-oblique view.

- **2** ♂, **2** ♀ (MYNU), Guiyang City, Nanming District, Tuyunguan, Guiyang Forestry Park, 2024.VII.26, Zi-Qi WANG leg.;
- **2** ♂ (FSPC), Guiyang City, Nanming District, Tuyunguan, Guiyang Forestry Park, 2024.VIII.7, Ming-Zhi ZHAO leg.;
- **1** ♀ (FSPC), Qiannan Pref., Longli Co., Shachong Forestry Park, 2024.VIII.12, Ming-Zhi ZHAO leg.;
- **1** ♂, **1** ♀ (FSPC), Guiyang City, Yunyan District, Qianlingshan Forestry Park, 2024.VII., Feng-Yi SUN leg.;
- **1** ♀ (SMPC), Zunyi City, Honghuagang District, Fenghuangshan Forestry Park, 2020.VII.13, Shi-Ming MAO leg.;
- **1** ♀ (SMPC), Guiyang City, Nanming District, Xiaochehe Wetland Park, 2022.VIII.16, Shi-Ming MAO leg.;
- **1** ♀ (MNHN), Kouy-Tchéou, Abbé Largeteau// Pseudodiceros nigrocyaneus, ♀ [hw.], Xu Hao det. II.2024;

China (Guangxi)

- **1** ♀ (MYNU), Tianlin Co., 2007.IX, An-Ming CHENG leg.;
- **1** ♀ (KSCJ), Jinzhong-Shan, 1700 m alt., Longlin County, W. Guangxi, CHINA, VII.2004, Yin et al. leg.// Pseudodiceros nigrocyaneus (Bourgoin, 1917), det. K.Sakai, 2016;
- **1** ♂ (CCCC), Baise City, Leye County, Yachang timberland, alt. 1137 m, 2016.V.31, Yan-Quan LU leg.;
- **1** ♂ (MYNU), Chongzuo City, Longzhou Co., Nonggang National Natural Reserve, 2015.VI.30, Lu QIU leg.;
- **1** ♂ (MYNU), Hechi City, Huanjiang Co., Chuanshan Town, Mulun National Natural Reserve, Disanguan, 2015.VII.21, Jian-Yue QIU leg.;
- **1** ♂ (MYNU), Chongzuo City, Longzhou Co., Zhubo Township, Nonggang Village, Longhengtun, 2023.V.6, Guo-Xi XUE leg.;

China (Yunnan)

- **1** ♀ (BMNH), CHINA-yunnan, 60 Km SEE kunming, Shilin (Stone Forest)[hw.]// 3-4.VII.1990, lgt. V.Kubáǩ [hw.]// Pseudodiceros nigrocyaneus [hw.]// BMNH{E}2015-37, Milan Krajčík;
- **1** ♂ (BMNH), CHINA-yunnan, 60Km SEE kunming, SHILIN-Stone Forset [hw.]// 3-4.VII.1990. lgt. V.Kubáň [hw.]// PSEUDODICEROS nigrocyaneus// COTYPE compared with holo(lecto)type specimen preserved in coll. of BMNH by M.Krajcik 2009// BMNH{E}, 2015-37, Milan Krajčík;
- **2** ♀ (RMNH), Sud Yunnan, Tche-Ping-Tcheol/ Coll. Guerry. fr. Le Moult 1925 [reverse side, hw. of Janson]// ♀// Museum Leiden, verz. F.T. Valck Lucassen [O.E. Janson]// Diceros nigrocyaneus Bourg.;
- **1** ♀ (RMNH, Syntype), Pe Yen Tsing, Yunnan// D. nigrocyaneus, co-type, Bourg. [hw. of Janson]// ♀// Diceros nigrcyaneus [sic!], Bourg., China [hw. of Janson]// Diceros nigrocyaneus Bourg., cotype [hw.]// Museum Leiden, verz. F.T. Valck Lucassen [O.E. Janson]// type// Diceros nigrocyaneus Bourg.// RMNH.INS., 1488007;
- **1** ♀ (RMNH, Syntype), Yunnan/ Donckier [reverse side, hw.]// Diceros nigrocyaneus, co-type, Bourg. [hw.]// ♀// Museum Leiden, verz. F.T. Valck Lucassen// type// nigrocyaneus[hw.]// Diceros nigrocyaneus Bourg.// RMNH.INS., 1488008;
- **1** ♀ (RMNH, Syntype), Pe Yen Tsing, Yunnan/ Donckier, Paris [reverse side, hw.]// Diceros nigrocyaneus, co-type, Bourg. [hw.]// ♀// Museum Leiden, verz. F.T. Valck Lucassen// type// Diceros nigrocyaneus Bourg.// RMNH.INS., 1488009;
- **1** ♀ (MNHN), Yunnan// MUSEUM PARIS, Pe yen tsin, H. Donckier, 1917 [hw.]// Diceros n.sp. 5 [hw.]// Diceros nigrocyaneus Bourgoin, Cotype [hw.];
- **1** ♀ (IRSNB), Sud Yunnan, Tche-Ping-Tcheou [Shipingzhou, present Shiping County, in Honghe Pref.]//223//Le Moult vend.: DICROS nigrocyaneus Bourgoin//R. Mus. Hist. Nat. Belg. I. G. 12.595;

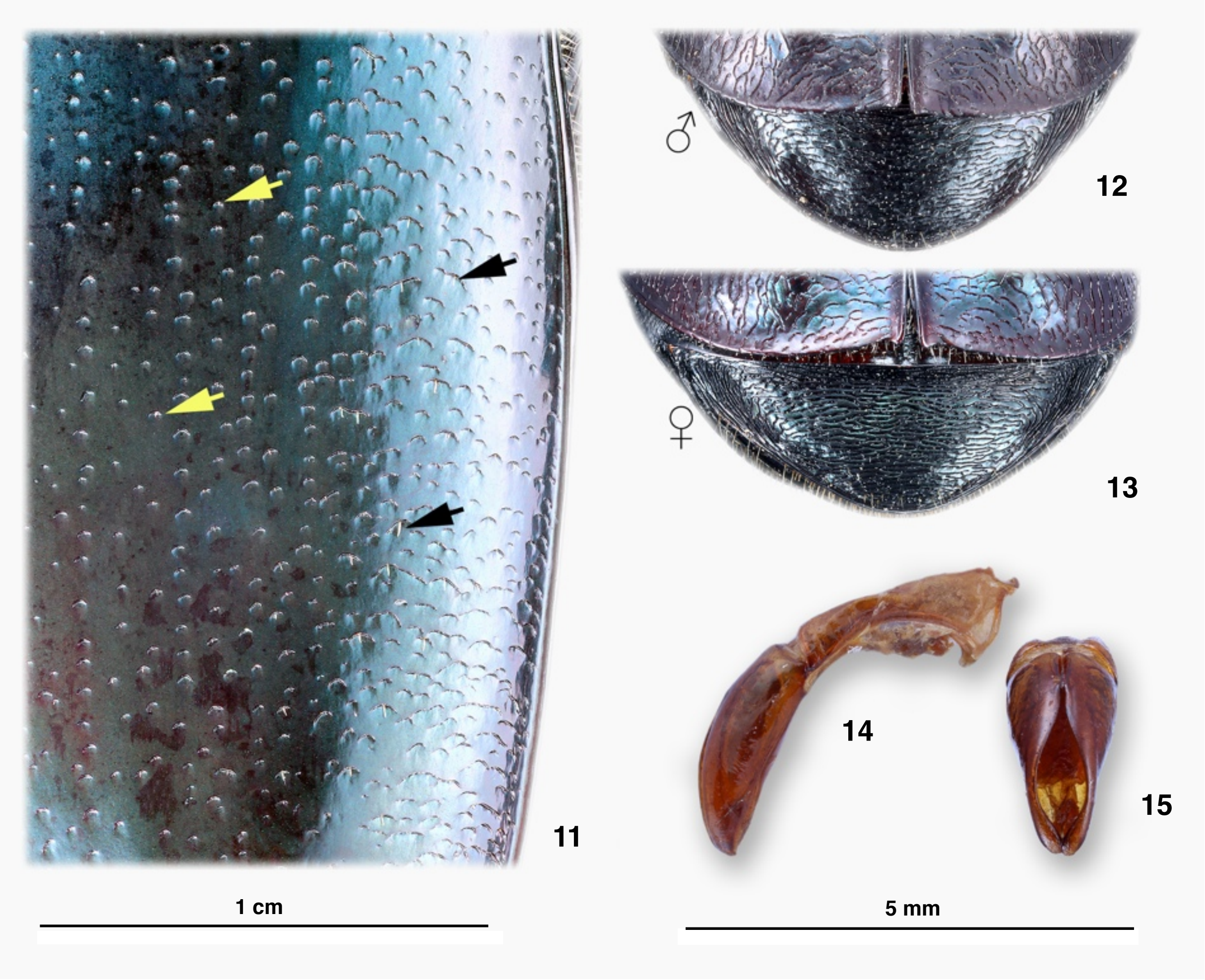


Fig. 11-15. Detailed mophological characters of *Pseudodiceros nigrocyaneus* (Bourgoin, 1917).

11. Mediodiscal area of female right elytron (yellow arrows indicate shorter setae, black arrow indicate longer setae). **12**. Pygidium of male. **13**. Pygidium of female. **14-15**. Parameres in lateral view and apical view.

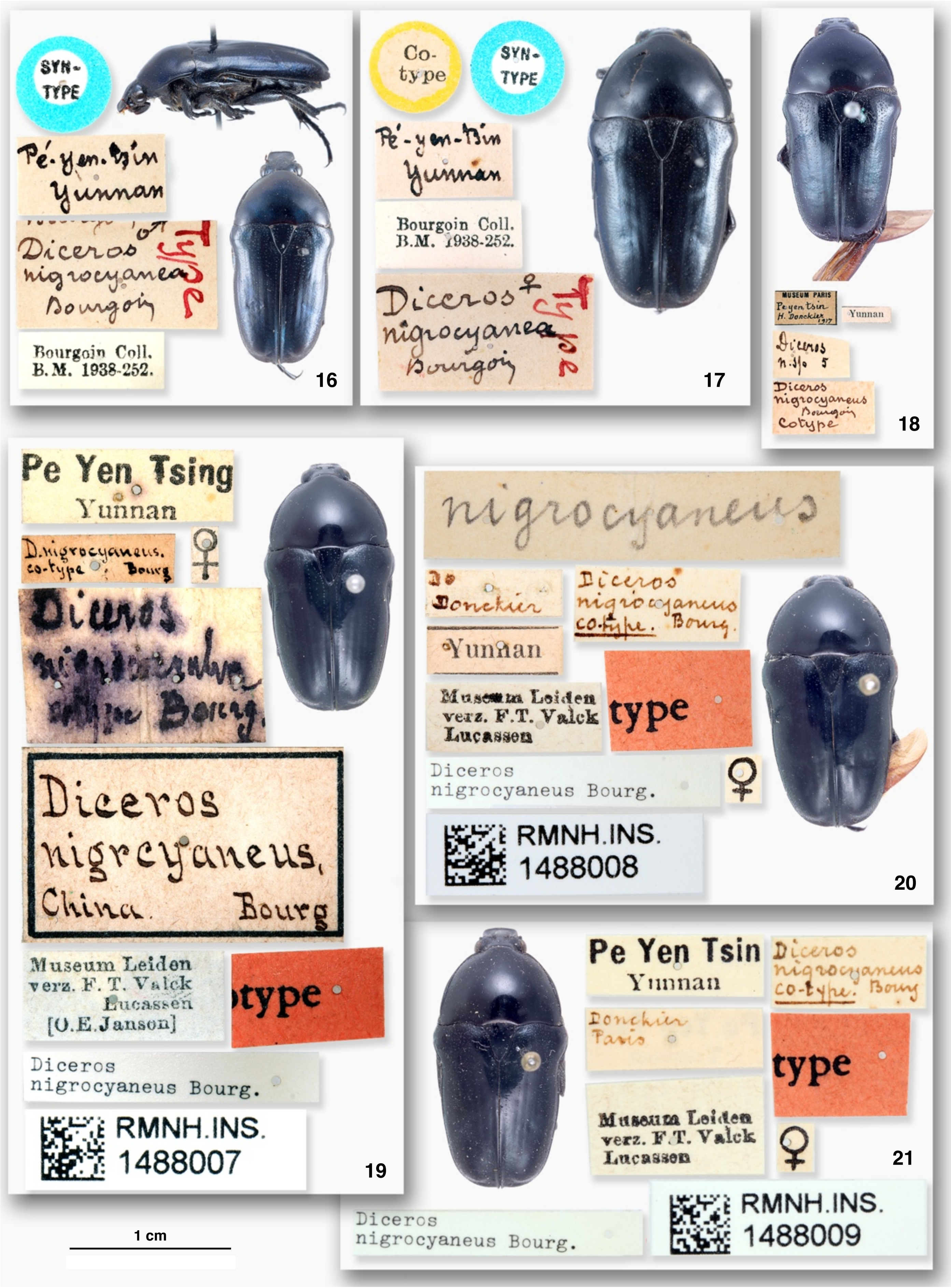

SYN-TYPE
Pé-yen-tsin Yunnan
Diceros ♂ nigrocyanea Bourgoin
Type
Bourgoin Coll. B.M. 1938-252.
16
Co-type
SYN-TYPE
Pé-yen-tsin Yunnan
Bourgoin Coll. B.M. 1938-252.
Diceros ♀ nigrocyanea Bourgoin
Type
17
MUSEUM PARIS Pe-yen-tsin H. Donckier 1917
Yunnan
Diceros n. sp. 5
Diceros nigrocyaneus Bourgoin Cotype
18
Pe Yen Tsing Yunnan
D. nigrocyaneus. co-type Bourg
♀
Diceros
Diceros nigrcyaneus, China. Bourg
Museum Leiden verz. F. T. Valck Lucassen [O.E.Janson]
type
Diceros nigrocyaneus Bourg.
RMNH.INS. 1488007
19
1 cm
nigrocyaneus
De Donckier
Diceros nigrocyaneus co-type. Bourg.
Yunnan
Museum Leiden verz. F.T. Valck Lucassen
type
Diceros nigrocyaneus Bourg.
♀
RMNH.INS. 1488008
20
Pe Yen Tsin Yunnan
Diceros nigrocyaneus co-type. Bourg
Donckier Paris
type
Museum Leiden verz. F.T. Valck Lucassen
♀
21
Diceros nigrocyaneus Bourg.
RMNH.INS. 1488009

Fig. 16-21. Historical specimens of *Pseudodiceros nigrocyaneus* (Bourgoin, 1917).
16. Male lectotype and labels (BMNH, Bourgoin Coll.). **17**. Female paralectotype and labels (BMNH, Bourgoin Coll.). **18**. Inauthentic female cotype and labels at MNHN. **19-21**. Inauthentic female cotypes and labels at RMNH.

- **1** ♀ (NSMT), C. NIGROCYANEUS BOURG. 1936, Kokyu [Kokiu, i.e., Gejiu, in Mengzi], YUNNAN, CHINE;
- **1** ♂, **1** ♀ (MNHN), YUNNAN;
- **1** ♂ (MNHN), Peyentsin, Yunnan [hw.];
- **1** ♀ (MYNU), Lijiang City, Yulong Co., Shigu Town, 2011.VII.23, Yuan BAI & Xue-Fei ZHANG leg.;
- **2** ♂ (MYNU), Chuxiong Pref., Dayao Co., Longjie Township, 2014-V, Ji-Hui LIU leg.;
- **3** ♂, **10** ♀ (MYNU), Kunming City, Panlong District, Heilongtan Park, 102°45.05' E, 25°08.35' N, alt. 2000 m, 2015.II.19 2rd Larvae, 2015.V.1 adults eclosed, Hao XU & Jian-Yue QIU leg.;
- **8** ♂, **13** ♀ (MYNU), F1 generation of the female from Kunming City, Panlong District, Heilongtan Park, 2016.IV adults eclosed;
- **3** ♂ (MYNU), Kunming City, 2014.V.2;
- **1** ♂ (MYNU), Kunming City, 2018.V;
- **1** ♀ (MYNU), Wenshan City, Panlong Forestry Park, 2016.VI, Ben-Fu LIAO leg.;
- **1** ♂, **2** ♀ (MYNU), Wenshan City, Panlong Forestry Park, 104°15.80' E, 23°21.04' N, alt. 1700 m, 2021.VI.7, Hao XU & Tian-Long HE leg.;
- **6** ♂, **8** ♀ (MYNU), F1 generation of the female from Wenshan City, Panlong Forestry Park, 2023.V.20-VI.13 adults eclosed;

Vietnam

- **1** ♂ (MNHN), Tonkin, RÉGION DE HOA-BINH// MUSEUM PARIS, 1931, A. DE COOMAN //Diceros nigroyaneus Boug. [hw.];
- **1** ♂ (KSCJ), Mt. Piaoac, Cao Bang, N. Vietnam, 1998.VI// Pseudodiceros nigrocyaneus (Bourgoin, 1917), det. K.Sakai, 2016;
- **1** ♂ (KSCJ), Border China, Ha Giang Prov., N. Vietnam, 10-20.VII. 1998// Pseudodiceros nigrocyaneus (Bourgoin, 1917);
- **1** ♀ (OMNH), 2012.VI.7, 607, BA BE NATIONAL PARK HOTEL-BA BE LAKE, alt. 200-250m, BA BE District, BAC KAN Province, N. VIETNAM;
- **1** ♀ (MNHN), TONKIN;
- **1** ♀ (MNHN), HOA-BINH, TONKIN;

Diagnosis. – Body small sized, dark blue; dorsal surface and pygidium almost glabrous (Fig. 1, 3). Dorsal surface of head sculptured; clypeus subquadrate, flat, margins slightly raised; frons with a slightly raised longitudinal ridge (Fig. 5, 8). Antenna blue to dark brown, antennal club long and inner side with short, dense, fulvous setae. Pronotum subtrapezoidal, widest near posterior margin; surface microsculptured; posterior margin without marginal line, notched in front of scutellum. Scutellum triangular, glabrous, lateral sides with several small punctures. Elytra gradually narrowing posteriorly, costa indistinct; disc with dense setiferous punctures in two sizes, setae short (Fig. 11, yellow arrows); punctures gradually transformed to short sinuous striolae in lateral declivity with longer setae (Fig. 11, black arrows); mediodiscal area with a shallow depression (Fig. 1, 3, 8); apicosutural angle pointed (Fig. 12-13); posterior margin somewhat serrated. Pygidium slightly convex, rugose, with numerous sinuous striolae; setae sparse, along

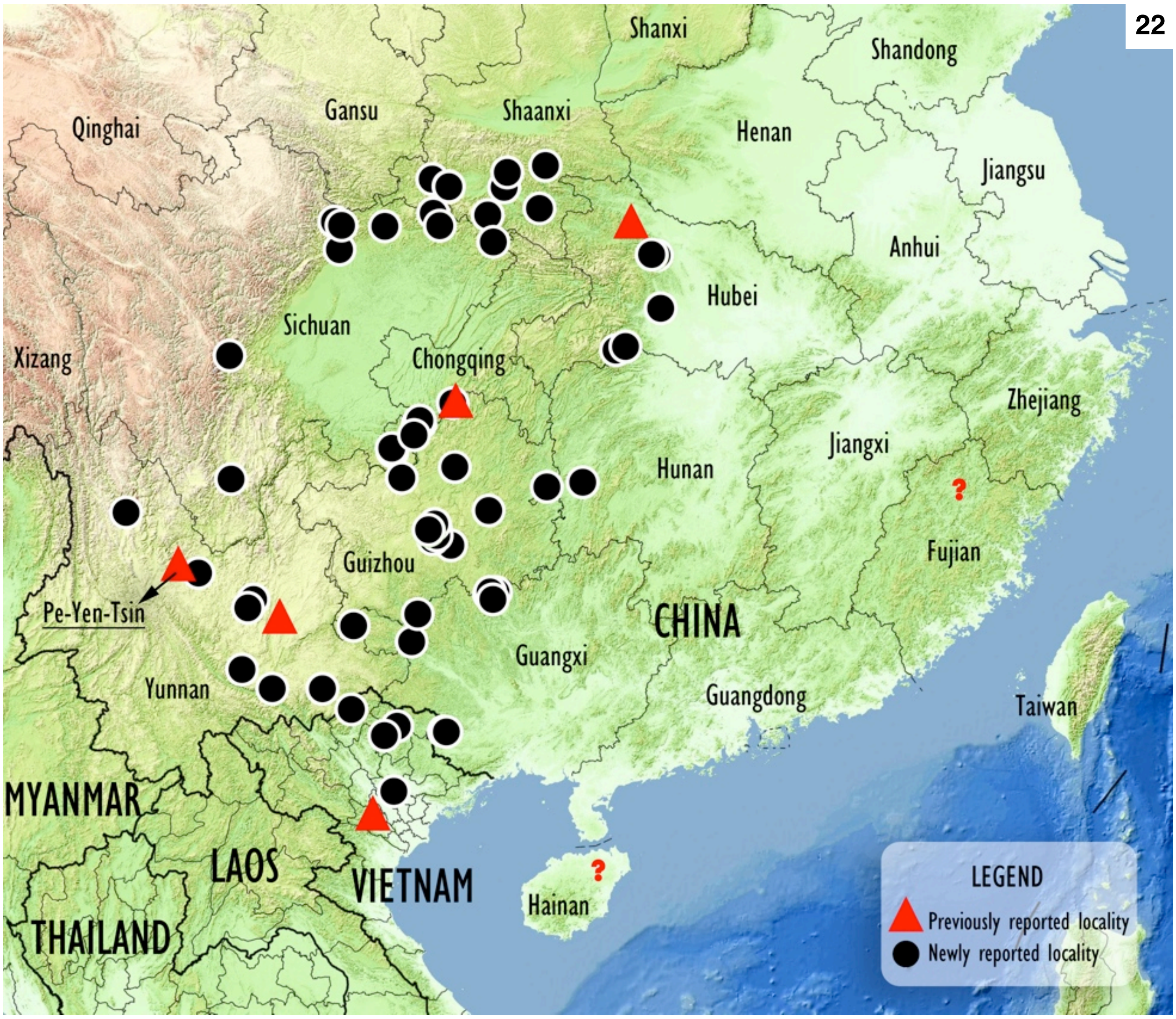
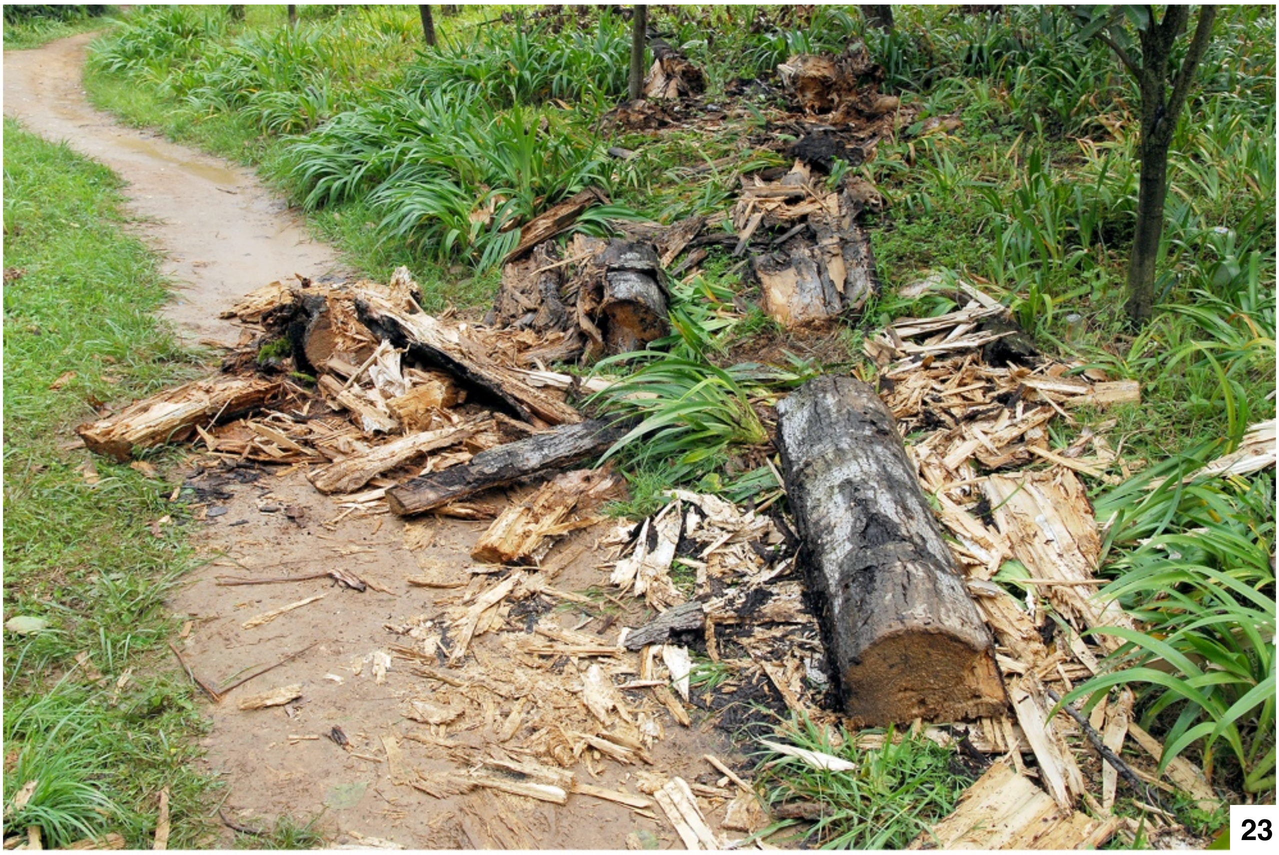
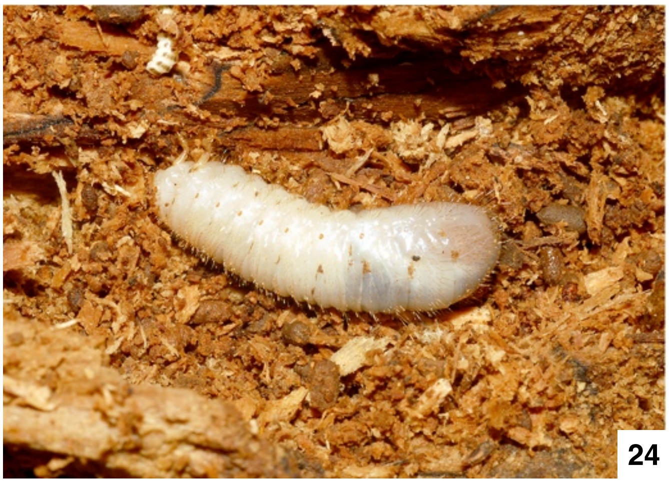


Fig. 22. Known collecting locations of *Pseudodiceros nigrocyaneus* (Bourgoin, 1917). Type locality is underlined, and question marks indicate unreliable records in Ma (2002a, b).





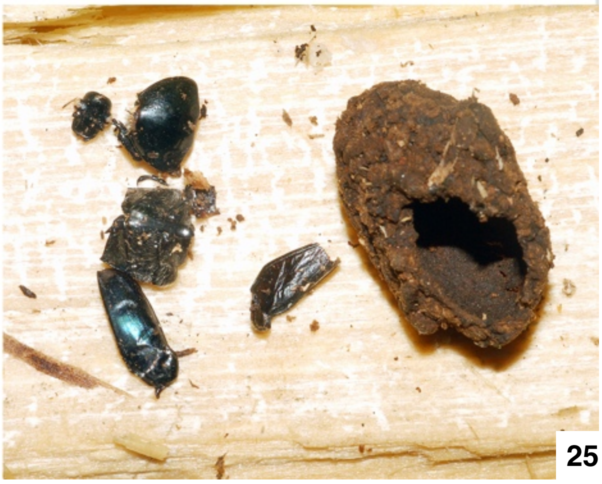


Fig. 23-25. Habitat of *Pseudodiceros nigrocyaneus* (Bourgoin, 1917).

23. Habitat of larva in Guiyang, China. **24**. Mature larva found in a rotten trunk on 7th, August 2012. **25**. Remains of an adult found in a cocoon in the same trunk.

posterior margin (Fig. 12-13). Ventral surfaces with dense, setiferous punctures or striolae, in lateral portion; setae long, gray (Fig. 2, 4). Mesometasternal process long, glabrous; tip subtriangular, bent toward the sternum (Fig. 6, 9). Posterior area of abdominal sternite without punctures. Legs with dense setiferous punctures, procoxae separated, trochanters glabrous, setea on mesofemur longer; protibia with 2 teeth along outer margin, apex with a slender spine; apex of meso- and metatibia with two spurs; metatibia with a near central protrusion on the outside, and a row of long setae along inner margin; tarsi simple, protarsus slightly thicker. Male genitalia simple, parameres gradually narrowing distally in apical view, slightly curved in lateral view, apex rounded (Fig. 14-15).

Sexual dimorphism. – The female resemble closely its male counterpart, but its body, protibia, and metatibia are slightly wider. The distal tooth of the protibia is longer, and the proximal tooth distinct and sharp. The outer tooth of the metatibia is slightly larger (Fig. 3) than in the male. The pygidium is wider (Fig. 13). The abdomen is convex, while that of male is slightly concave in lateral view (Fig. 6), with a shallow longitudinal groove between abdominal sternites III-VII (Fig. 7). The anterior margin of the female anal sternite is straight and the posterior margin is curved (Fig. 4), while in male the anterior margin is slightly protruding forward, and the posterior margin is broadly curved (Fig. 3).

Measurements. – Total body length: male 14.5-18.1 mm, female 14.9-19.6 mm; body width: male 6.8-8.5 mm, female 6.8-9.2 mm.

Distribution. – China: Chongqing, Guangxi (**new record**), Guizhou (**new record**), Hubei, Hunan, Shaanxi (**new record**), Sichuan (**new record**), Yunnan; Vietnam.

Natural history. – *Pseudodiceros nigrocyaneus* is a typical saproxylic species, with larvae living in rotten wood, like members of Taenioderina Mikšić, 1976 and Trichiini Fleming,

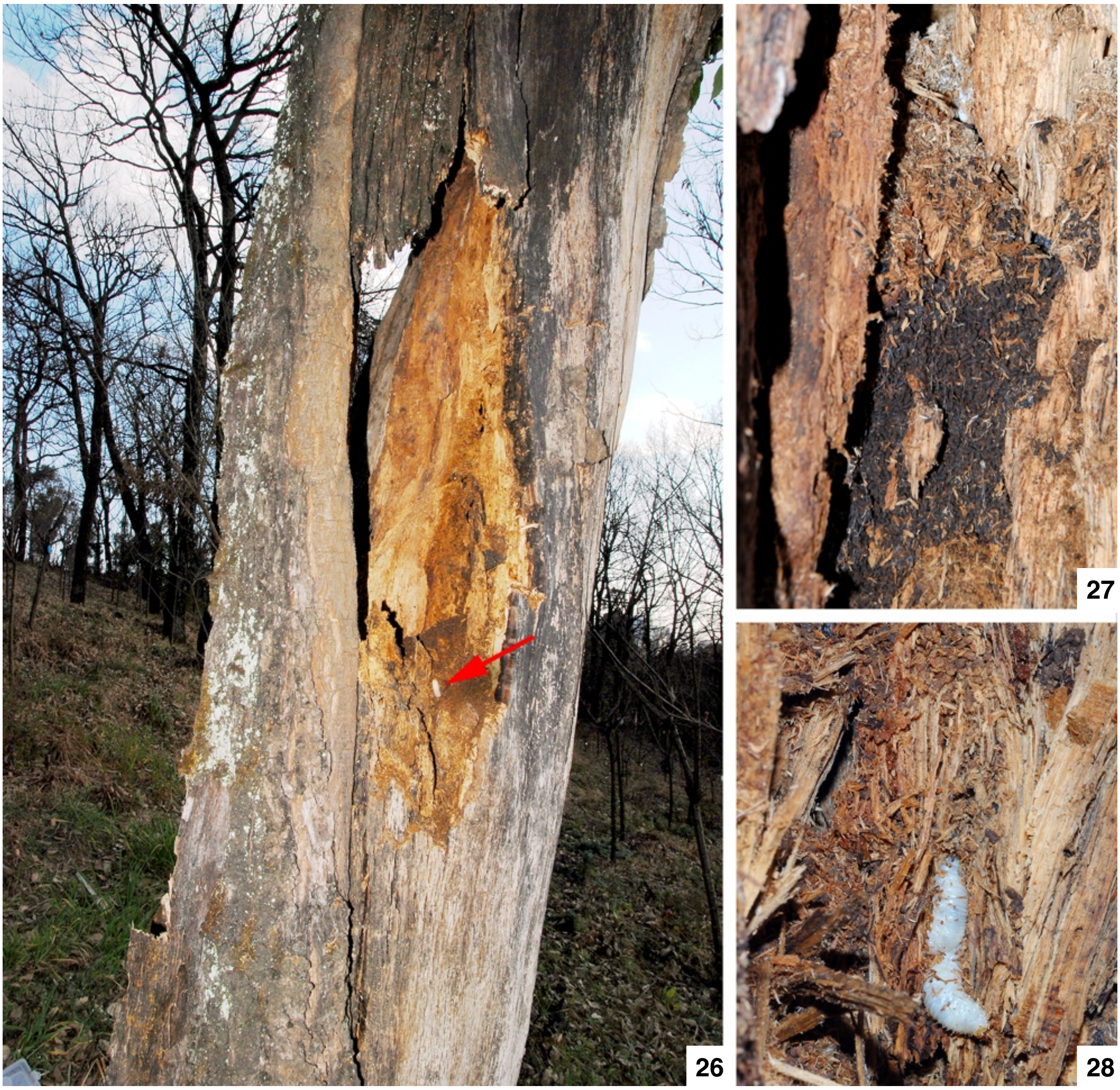


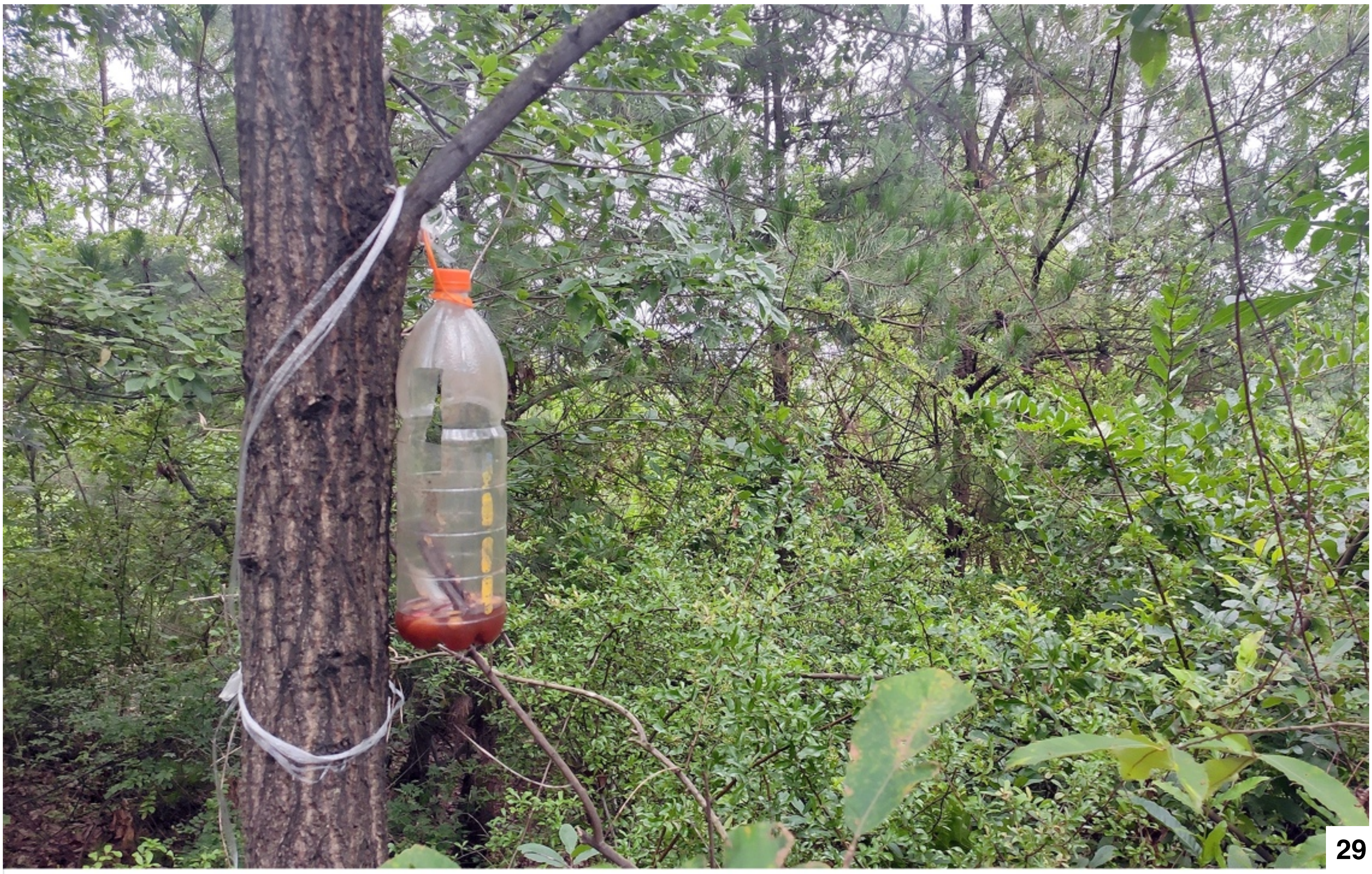
Fig. **26**-**28**. Habitat of larva of *Pseudodiceros nigrocyaneus* (Bourgoin, 1917).

26. Habitat of larva in Kunming, China (red arrow indicates a larva). **27**. Fecal pellets of larva found in a dead tree on 19th, February 2015. **28**. Mature larva found in the same tree.

1821. This species, therefore, is generally an inhabitant of moist forests. The mature larvae of this species have been repeatedly found in decaying wood (see details in the additional material examined section), such as one mature larva excavated from a fallen rotten trunk in Guiyang Forestry Park in the summer of 2012 and 2015 (Fig. 23-25), and several larvae surrounded by large amounts of fecal pellets found in standing dead trees in the Simianshan Natural Reserve of Chongqing and the Kunming Heilongtan Park of Yunnan (Fig. 26-28) in the winter of 2014 and 2015, respectively. Adult remains within a cocoon were also found in the same trunk (Fig. 25). Wild-collected and bred larvae were artificially reared by feeding them wet, rotten wood chips under laboratory room conditions (Fig.33). Pupation was usually reached in spring, and new adults emerged from late April to early June (Fig. 34-36). Adults in the wild occur mainly in late spring and during summer, most often from June to August, but a few were also captured as late as September and early October. Adults can be attracted to sap flows of *Broussonetia papyrifera* (L.) (Rosales: Moraceae) or to traps baited with fermenting fruit hanging in oak forests during summer (Fig. 29–30). The beetles were observed flying around certain branches or on the canopy of *Quercus acutissima* Carruthers (Fagales: Fagaceae). It is presumed that this behavior was related to a search for sap flows or females perched on branches.

Discussion

Little has been published on the larval feeding habits of Goliathini species, and their larvae have often been found in the middens of herbivore dung, within rotten trunks, humus, and leaf litter (Perissinotto *et al.* 1999; Nogueira *et al.* 2004; Le Gall 2010; Malec 2015; Malec & Sipek 2016, 2017; Maquart & Malec 2017). The mixture of these matters was often adopted in morphological studies of immature stages (*e.g.*, Nespoulous 2005; Šípek *et al.* 2008; Micó *et al.* 2008). It has also been reported that dog food may be added to satisfy the nutritional requirements of some larvae (Vendl & Šípek 2016). It is well known that deeply decaying sawdust of broadleaf wood was used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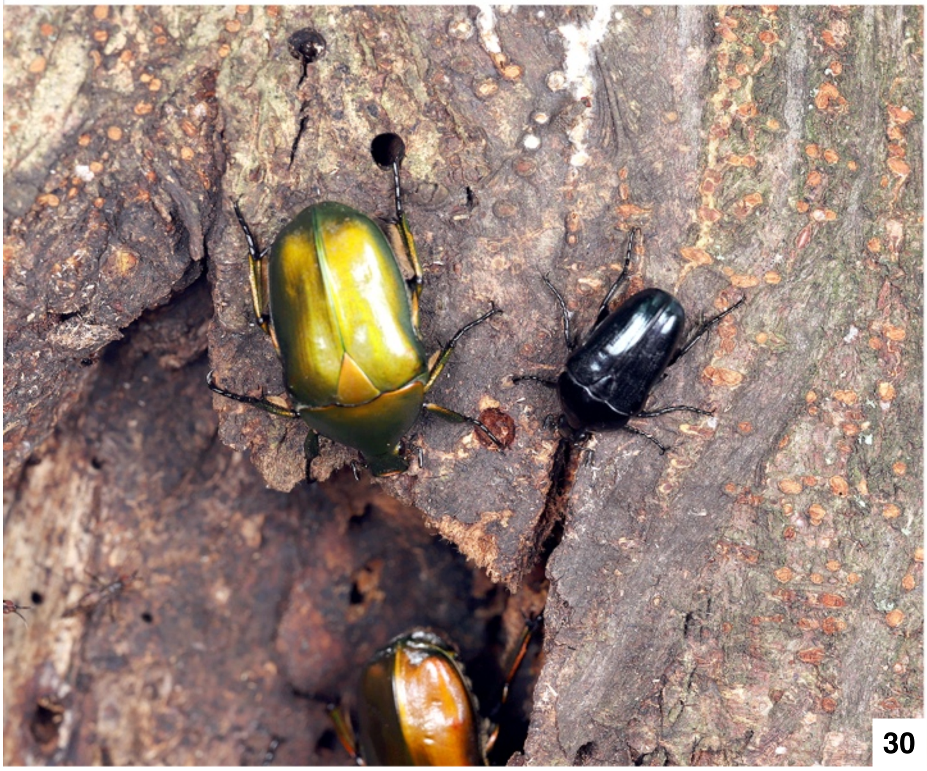
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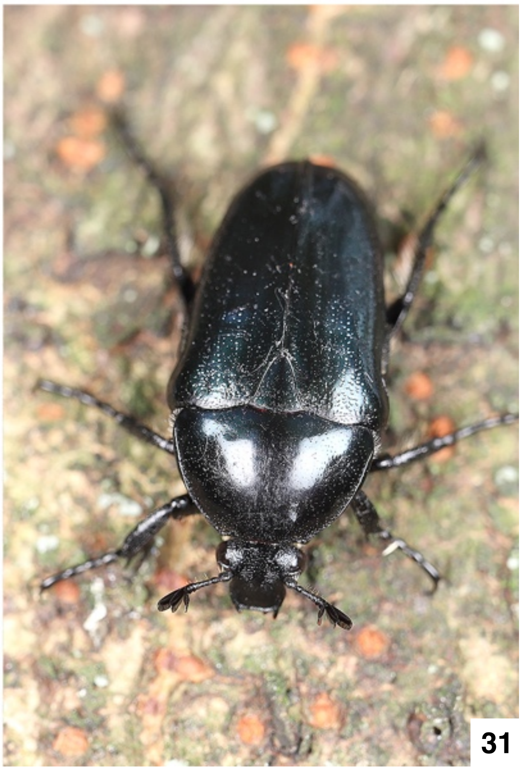
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Fig. **29**-**31**. Habitat of adult of *Pseudodiceros nigrocyaneus* (Bourgoin, 1917).

29. Fruit trap hanging in oak forest in Mount Tiandangshan, Mianxian County, Hanzhong, China in July 2023. **30**. Adult attracted to the sap flow of *Broussonetia papyrifera* (L.) in Hanzhong, China on 21th, June 2021. **31**. Adult on trunk of the tree *B. papyrifera* (L.) in Binjiang Wetland Park, Hantai District, Hanzhong, China on 19th, June 2021. (All photographed by Yi-Wei YAO).

by hobbyists to breed some giant Goliathini from Africa and Asia, such as species of the genera *Goliathus* Lamarck, 1801, *Eudicella* White, 1839, *Dicronorhina* Hope, 1837, and *Jumnos* Saunders, 1879 (McMonigle 2008; Micó *et al.* 2008). However, this may not be consistent with their larval habits in nature, since some change in feeding habits in captivity may be reasonably expected. Some of them have indeed been found in rotten wood in the wild (*e.g.*, Jerath & Unny 1965; Lumaret 1985; Le Gall 2010). The larva of *Pseudodiceros nigrocyaneus* is also saproxylophagous, but this seems rather unusual in Asian Goliathini. According to our field collecting and artificial breeding during the past decade, the larvae belonging to most genera of Asian Goliathini inhabit leaf litter and can complete their life cycle by consuming only decomposing leaves or leaf litter (Authors unpublished data). However, it is to be expected that more species with larvae living in rotten wood will be discovered among this group.

The natural history of *Pseudodiceros nigrocyaneus* not only enriches our knowledge of the feeding habits of Goliathini larvae, but is also deemed to be helpful for the understanding of the evolution and distribution patterns of flower beetles. Adults and larvae of *P. nigrocyaneus* are usually found in the forests of humid climate zones, such as the forests of the Danxia landform at the junction of Chongqing, Sichuan, and Guizhou (Fig. 38), and the Karst forests in Hubei, Hunan, Guizhou, and Guangxi (Fig. 37). Interestingly, this species has been captured several times in forests at an altitude around 2000 meters in arid valleys of western Sichuan and northwestern Yunnan (see Fig. 22). These arid valleys represent a special ecological environment, characterized by dry climate and poor vegetation, but broad-leaved forests can be found on tops of the mountains along river banks, where the habitats become moist (Fig. 39). This may be the reason why its distribution range extends westward to the Hengduan Mountains. Urban parks in some mountainous cities in southern China, such as Hanzhong, Zunyi, Guiyang, and Kunming, have vast broad-leaved forests that can also serve as biotopes for this small Goliathini beetle (Fig. 23-31). However, as habitats for numerous decomposers in ecosystems, the significance of dead and decaying wood in biodiversity conservation has not been received deserved attention (Nieto and Alexander 2010). Instead, dead and decaying wood is often treated as a hidden danger of fires or a shelter to forestry pests, and thus be intentionally cleared by management. Therefore, *P. nigrocyaneus* was considered Near Threatened by the author (HX) during the Red List assessment of Chinese insects in 2020, and the continuous loss of habitat being the key threat.

The northernmost collecting sites of this species are currently located in the Qinling Mountains which is usually considered as the boundary between Palaearctic and Oriental Realms (Zhang 2011). The mountain areas in western Hubei and Hunan form the easternmost boundary of the occurrence of *P. nigrocyaneus*. This species has also been listed from Hainan and Fujian (without precise location, see Ma 2002a, 2002b), which are far from the known distribution range as shown on the updated map (Fig. 22). The identification of this remarkable species should be straightforward and reliable, while no voucher specimens have so far been found and no further records have been reported recently from these two provinces. Hence, the records from these two localities are presumably based on mislabeled specimens. Besides, the previous records of *P. nigrocyaneus* from Sichuan (Mikšić 1977; Sakai & Nagai 1998) should be attributed to Chongqing since these records were based on specimens collected from Mt. Jinfo-shan of Chongqing which was formerly part of Sichuan. This species is here newly recorded from Sichuan by examining several individuals caught from the mountains around the Sichuan basin.

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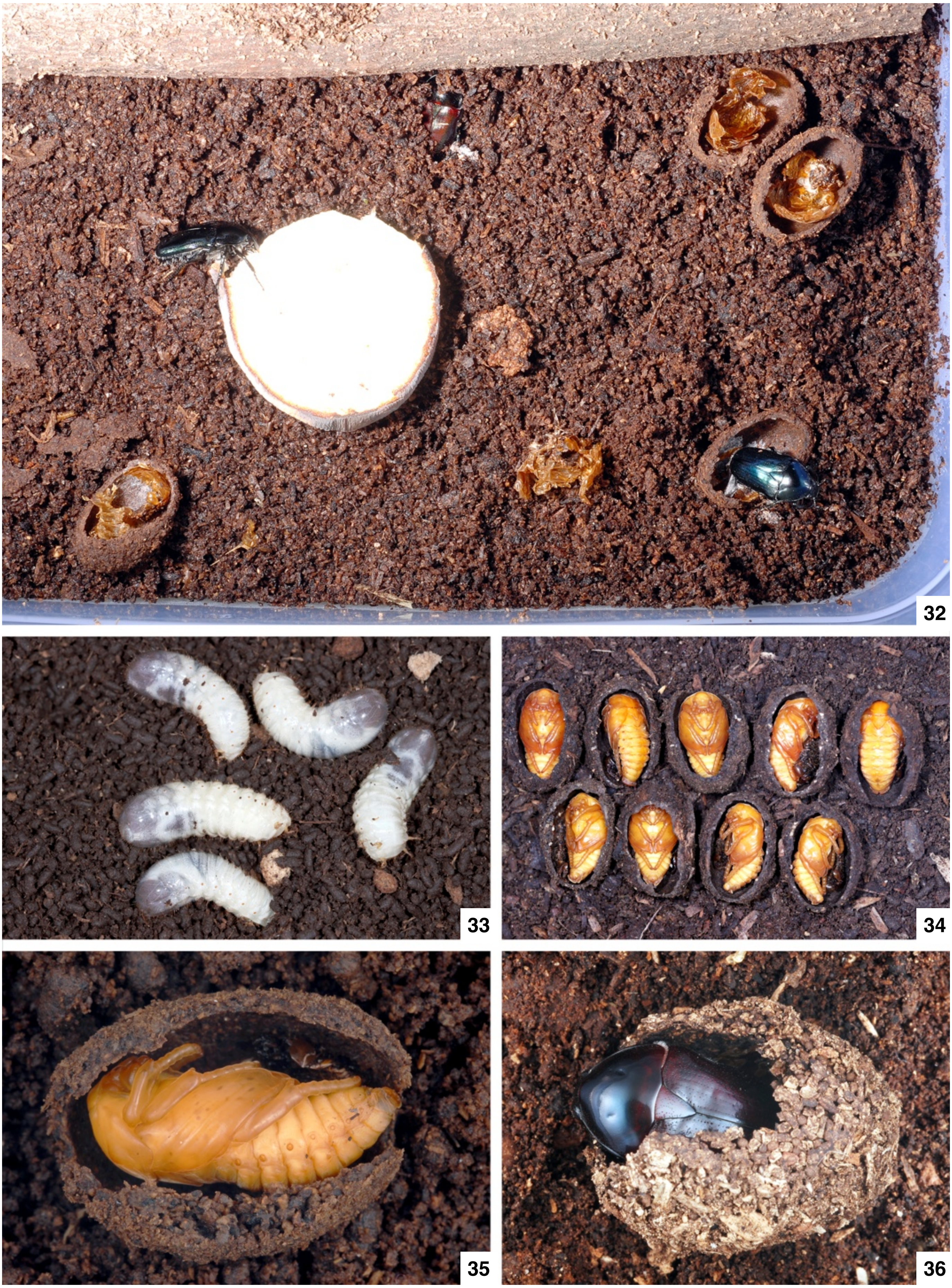

Fig. 32-36. Life cycle of *Pseudodiceros nigrocyaneus* (Bourgoin, 1917).

32. Newly eclosed adults feed on ripe banana in a plastic container filled with a 15-cm layer of wet, rotten oak wood pieces. **33**. Mature larvae in the same container. 34. Pupae in cocoons in the same container. 35. Lateral view of a female pupa in cocoon. **36**. A newly eclosed adult in cocoon.

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Article proofreading. – HX
Material study. – XYZ, STZ, HX
Author of the figures. – HW, HX

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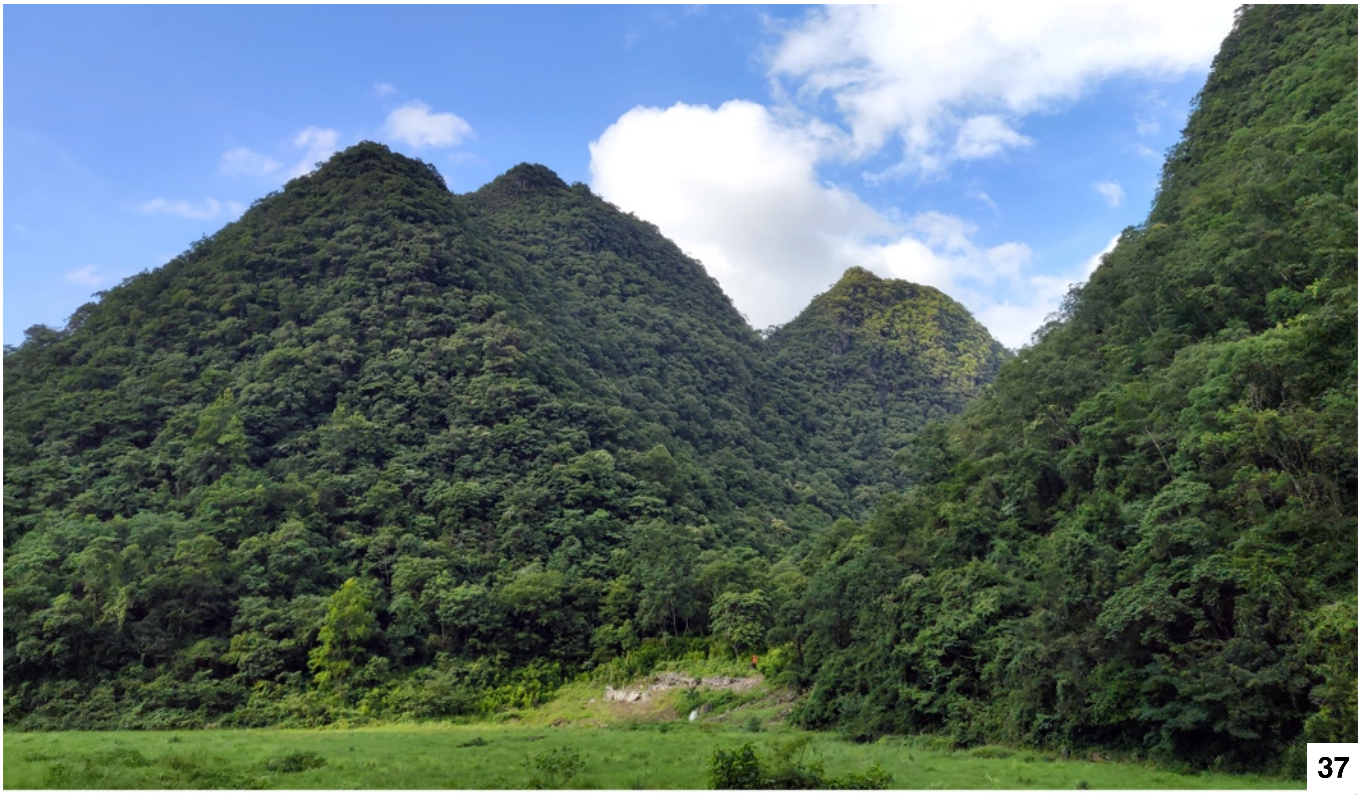
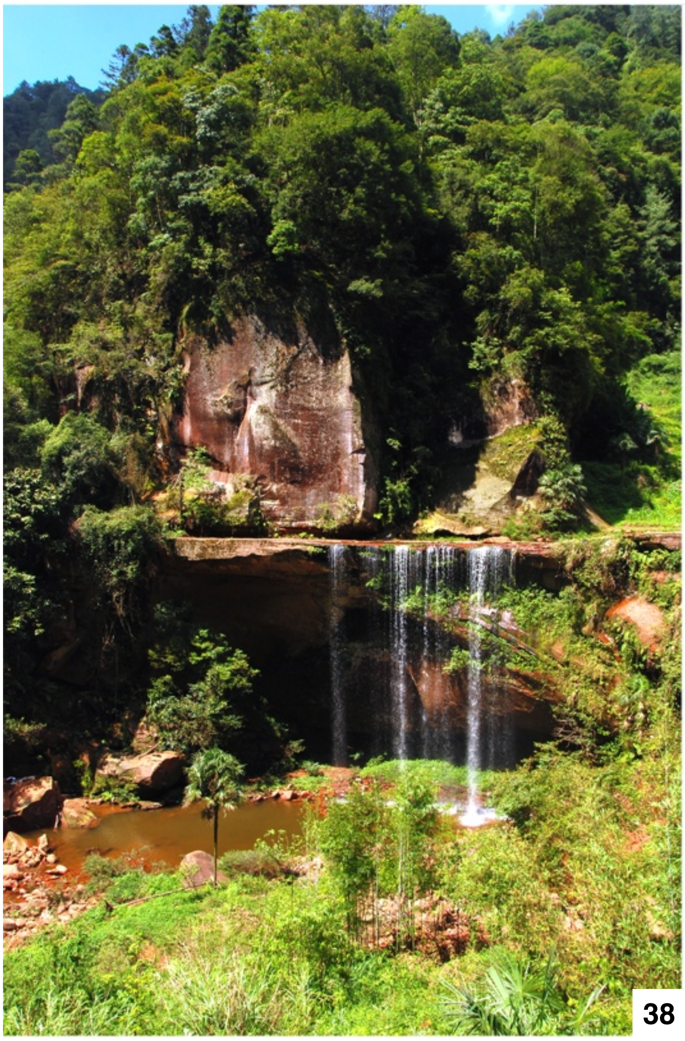
Résumé

Hui Wen, Xin-Yuan Zhang, Shu-Tong Zhang & Hao Xu, 2024. – Répartition géographique en Asie et biologie de *Pseudodiceros nigrocyaneus* (Bourgoin, 1917) (Coleoptera : Scarabaeidae : Cetoniinae). *Faunitaxys*, 12(57): 1 – 15.

La répartition géographique de *Pseudodiceros nigrocyaneus* (Bourgoin, 1917) est mise à jour. L'habitus et les caractères diagnostiques de l'espèce sont illustrés et un lectotype est désigné. L'histoire naturelle de cette espèce est également documentée. Les larves se nourrissent de bois pourri dans la nature, ce qui diffère de l'habitude alimentaire des larves de la plupart des Goliathini asiatiques.

Mots-clés. – Lamellicornia, Goliathini, Rhomborhinina, *Pseudodiceros*, lectotype, désignation, larve, Asie, Région Orientale, Chine, Vietnam.





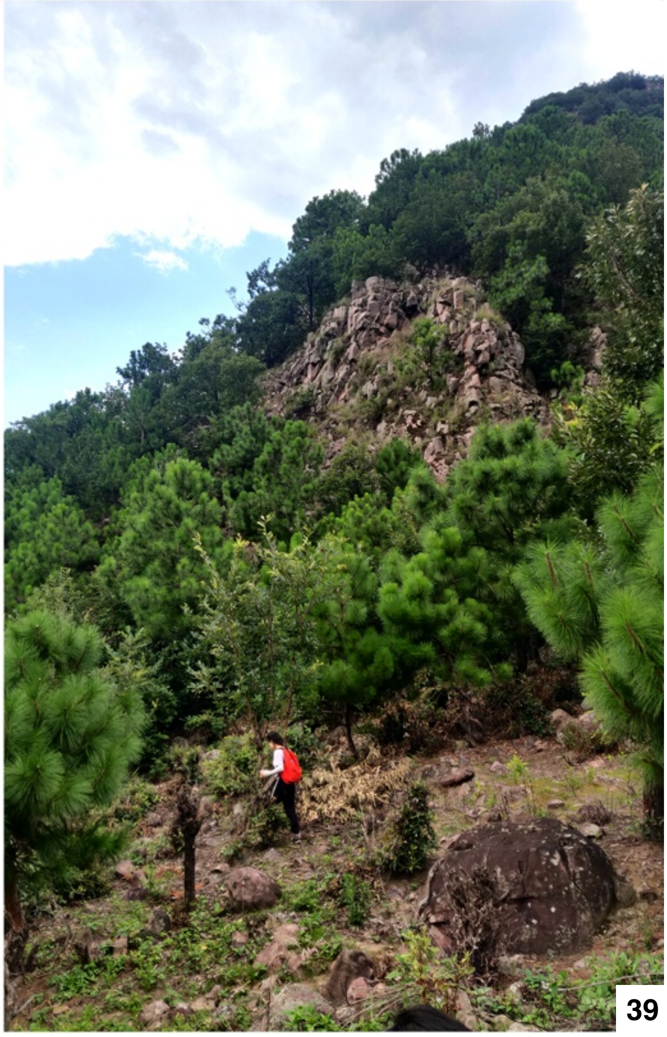


Fig. 37-39. Habitats of *Pseudodiceros nigrocyaneus* (Bourgoin, 1917).

37. Karst forest in Maolan Nature Reserve, Libo County, Guizhou, China. **38**. Forest in Danxia landform in Mount Simianshan Nature Reserve, Chongqing, China. **39**. Forest in the arid valley of Dechang County, Sichuan, China.

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Illustration de la couverture :

Male of *Pseudodiceros nigrocyaneus* feeding on banana in captivity, Kunming, Yunnan, China (1st, May 2015).

Crédits:

Yi-Wei Yao : Fig. 29-31.
Hao Xu : Fig. 1-28, 32-39 & couverture.

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